Abstract Submitted
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High-Speed X-ray Investigation of Granular Jets[1] JOHN ROYER, ERIC CORWIN, ANDREW FLIOR, BRYAN CONYERS, MARIA-LUISA CORDERO, MARK RIVERS, PETER ENG, HEINRICH JAEGER, James Franck Institute, The University of Chicago — When a heavy sphere is dropped onto a bed of loose, fine sand, a large, focused jet of sand shoots upward.[2] [3] Experiments at reduced air pressure reveal that the jet in fact consists of two components: a wispy, thin jet that varies little with pressure followed by a thick air-pressure-driven jet [4] . To observe the initial stages of jet formation inside the granular bed, we employed x-ray radiography using the high-intensity beams available at the Advanced Photon Source. This technique allowed us to image the motion of the sphere and the evolution of the void left behind it at frame rates up to 6600 frames per second. The x-ray movies reveal that gravity-driven collapse produces the initial, thin jet, while the compression of an air pocket trapped below the surface drives up the thick jet. We also find that the interstitial air alters the compressibility of the sand bed. In vacuum a visible compaction front precedes the ball, while at atmospheric pressure the sand flows out of the way of the ball, behaving more like an incompressible fluid.

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[2]Thoroddsen, S. T. and Shen, A. Q. Phys. Fluids **13**, 4-6 (2001).
[3]Lohse, D. et al. Phys. Rev. Lett. **93** (2004).
[4]Royer, J. et al. Nature Physics, December 2005.

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